REMARKS

Claims 23-32 remain in the application. Claims 1-22 have been cancelled without prejudice or disclaimer and Applicant reserves the right to re-present these claims in a later application. Claim 23 has been amended for improved clarity. No new matter has been added.

Specification

The specification was objected to for allegedly attempting to incorporate critical subject matter by reference to a non-U.S. Patent publication, the "Astrogator module" of the "Satellite Tool Kit (STK)" on page 7, line 8.

Applicant respectfully submits that the citation to the "Astrogator module" of the "Satellite Tool Kit (STK)" on page 7, line 8 was to satisfy the Best Mode requirement of 35 U.S.C. 112 (Applicant's prior statement relating Astrogator and STK to Enablement was in error) and that no information critical to the operation of the claimed invention has been incorporated by reference thereto. The "Astrogator module" of the "Satellite Tool Kit (STK)" is a software program that employs the commercial embodiment of the claimed invention.

The Examiner's Response to Arguments

35 USC § 112(1)

The Examiner found the Applicant's arguments non-persuasive for attempting "to restate the enablement issues in the case" and avoiding "addressing the specific merits of the examiner's rejection....[n]amely, <u>how</u> do the FindIn function, building operation, and combined transformation processes operate <u>within the system</u> in creating the claimed target (spatial parent) objects?"

On September 24, 2003, Applicant's representative filed an "Applicant Initiated Interview Request Form" (PTOL-413A) with the Examiner to "Discuss 'FindIn' function and show materials available to one of skill in the art" in an attempt to clarify this issue, but received no response. Applicant respectfully submits that the issues pending in this application can be resolved through improved communication and invites the Examiner to contact the Applicant's representative to address any perceived miscommunication related to the Office's position.

Upon discussion with the present inventor, Sergei Tanygin, it appears that the disclosed "FindIn function" disclosed in the present specification is *not* a standard mathematical function

or a standard function call of a programming language, but rather a call to the algorithm / subroutine used by the Astrogator module, so its disclosure relates solely to the best mode requirement of 35 USC 112.

Indeed, the "FindIn function" is not presently claimed, but rather dependent claim 25 recites:

> "wherein defining said new spatial object relative to said one or more parent spatial objects comprises:
>
> finding said new spatial object in one parent spatial object and using information explicitly provided by said analyst into the graphic user interface to obtain a first transformation;
>
> finding said one parent spatial object in said new spatial object to obtain a second transformation."

In the submission filed under 37 CFR 1.114, Applicant cited the portions of the specification that taught how to find one object in another, such as at Page 1, line 16 to page 2, line 10; Page 2, lines 16-23; and Page 7, line 10 to page 8, line 8.

However, the Examiner's preoccupation with the unclaimed "FindIn function" has resulted in absurd statements, such as at page 3 of the final Office Action where it states:

> "No flowchart, algorithm, or description is given of specifically how the FindIn function **finds the point object 120 in the existing coordinate system**..."

As previously stated, Applicant has *not claimed* the FindIn function and one of ordinary skill in the art (as well as anyone else with a basic grasp of algebra and geometry) knows that a point object can be found in an existing coordinate system by finding (i.e., mapping and/or rotating) its known axial coordinates, i.e., x, y, and z in a Cartesian coordinate system.

Indeed, each of the Examiner's reasons for maintaining the rejection under 35 USC 112(1) in part 3 of the Office Action explicitly rely upon some failure to disclose the specifics of the *unclaimed* FindIn function.

35 USC § 112(2)

Although the Examiner contends that the definition of "transformation" is not the issue regarding the definiteness of the term "combined transformation," Applicant submits that a proper understanding of the term as a well known mathematical term clarifies the claim. Furthermore, it is the Applicant's position that the Examiner's failure to understand this term in

its proper context is an underlying cause of miscommunication with respect to the § 112 rejections in the present case. As previously stated, the present invention is not to the mathematics involved in orbital analysis, but to the creation of new objects being modeled based on modification of parent objects.

"Transformations" and "combined transformations" are well known terms of art used in linear algebra for solving simultaneous equations, typically with matrices. A transformation typically describes one object relative to another in 2D or 3D space. These transformations can be combined to solve for unknowns.

A search of the terms "algebra first second transformation" at www.google.com resulted in the document written June 11, 1998 titled "Using Transformation Matrices to Change from One Coordinate System to Another in Robotics," located at http://www.math.bcit.ca/examples/robotics/linear_algebra/ (see Exhibit D). This document discusses two "transformations" - world to base ${}^{W}T_{B}$ and base to hand ${}^{B}T_{H}$ - which "can be combined into a single transformation from the world to hand, like this: ${}^{W}T_{H} = {}^{W}T_{B}\ {}^{B}T_{H}$" to be solved with matrices.

Another Google™ search of the term "combined transformation" resulted in finding the document titled "An Example of Calculating a Combined Transformation" related to the rotation of a triangle, located at http://www.cs.bham.ac.uk/resources/courses/graphics/Example_1.pdf (see Exhibit E) and the document titled "Geometric transformation matrices" which discusses transformation equations, matrices and combinations, located at http://pdelagrange.free.fr/labdev/understand/transform.html (see Exhibit F).

As clearly illustrated by Exhibits D, E, and F, the terms "transformation" and "combined transformation" have well known meanings in the art of solving 2D and 3D problems. In the present case, since the claims and specification do not define the term, the terms are presumed, under M.P.E.P. 2111.01(II), to have the ordinary meaning attributed to them by those of ordinary skill in the art. *Sunrace Roots Enter. Co. v. SRAM Corp.*, 336 F.3d 1298, 1302, 67 USPQ2d 1438, 1441 (Fed. Cir. 2003); *Brookhill-Wilk 1, LLC v. Intuitive Surgical, Inc.*, 334 F.3d 1294, 1298 67 USPQ2d 1132, 1136 (Fed. Cir. 2003). Since transformations are, by definition, the mathematical description of one object relative to another, the terms are further definite when "based on" the parent object and would be indefinite if they *did not* specify a related object from which the transformation is obtained

Hierarchical Data Techniques

The fact that the spatial objects in STK are disclosed in certain documents as organized into a hierarchy does not alter the fact that the ***claimed*** objects are spatial objects and are not drawn to any hierarchical data techniques.

Claim Rejections - 35 USC § 101

The claims were rejected as allegedly lacking utility under 35 USC 101. However, a method or apparatus that allows a spacecraft maneuver analyst to model orbital maneuver phenomena on a computer without needing to hard-code a software solution by defining new spatial objects related to orbital maneuver phenomena (such as coordinates systems, coordinate systems primitives, derivatives of coordinate system primitives, and combinations thereof, as found in claim 24) based upon parent spatial objects related to orbital maneuver phenomena clearly has utility.

For example, in modeling a flyby of a moon of Saturn, it might be useful to an analyst to have a Saturn-centered, Saturn-fixed coordinate system. Instead of hard-coding such a coordinate system or creating one from scratch in the GUI, a new spatial object to define such a coordinate system can be created based upon a first parent spatial object, a preexisting Earth-centered, Earth-fixed coordinate system and a second spatial object, the vector defining the known location of Saturn relative to the Earth. Indeed, an analyst would have no need for a new spatial object unless he/she desired to *use it in modeling orbital phenomena*, so any such new spatial object inherently has utility.

The resulting new spatial object is not a mere mathematical construct, but a construct that represents a desired modeled feature of orbital maneuver phenomena. As further illustrated by claim 30, the new spatial object has additional utility - i.e., "said new spatial object is subsequently reused by said analyst as a parent spatial object to create a different new spatial object."

Information Disclosure Statement

As previously submitted, the Astrogator module of the STK is not prior art, but rather the inventor's commercial embodiment of the invention.

Claim Rejections - 35 USC § 112

First Paragraph

"FindIn Function" and "Transformation"

Claims 1-32 were rejected under the first paragraph of 35 USC § 112 for allegedly having a non-enabling disclosure with respect to finding target objects in terms of the parent objects and obtaining and combining transformations based on parent objects.

As submitted above, the specification describes what type of spatial objects can be found in other spatial objects (points in coordinate systems, etc.) and one of ordinary skill in the art of linear algebra and geometry readily understands how to obtain transformations and combine transformations, as illustrated by Exhibits D, E, and F.

"Critical Subject Matter" in Astrogator and STK

The claims were additionally rejected under 35 USC 112(1) for an alleged non-enabling disclosure of critical subject matter incorporated by reference to Astrogator and STK.

As stated above, the Astrogator module of the STK software contains the commercial embodiment of the present invention, but no critical subject matter is incorporated by reference thereto.

Indeed, creating, defining, and transforming spatial objects relative to a parent spatial object is both disclosed in the specification and well known to one of ordinary skill in the art, as illustrated by Exhibits D, E, and F. *This is basic algebra and geometry.*

For the above-mentioned reasons, Applicant submits that the written description satisfies the requirements of the first paragraph of 35 USC § 112 and requests reconsideration.

Claim Rejections - 35 USC 112(2)

"Combined Transformation"

Claims 1-22 were rejected due to the term "combined transformation" allegedly being indefinite. This rejection is moot due to the cancellation of claims 1-22. However, it is unclear to the Applicant why "combining said first and second transformations" in claim 25 was not also objected to. Assuming that this omission was unintentional, Applicant notes that, as previously presented and illustrated in Exhibits D, E, and F, combining of transformations and the associated terms used in the claims are definite and well known in the art of linear algebra.

"Related to Orbital Maneuver Phenomena" and "Hard-Code"

Claims 23-32 were rejected as being indefinite under 35 USC 112(2) based upon the allegation that:

> "since neither the claim, nor the specification, specifically define how spatial objects are 'related to' the orbital maneuver phenomena. Further, the limitation reciting 'without needing to <u>hard-code</u> a software solution is also vague and indefinite since, again, neither the claim, nor the specification, specifically define what parameters are <u>not</u> hard-coded."

Applicant respectfully traverses these grounds of rejection. With respect to the spatial objects, the specification discloses at numerous places how the spatial objects are related to orbital maneuver phenomena. For example, with respect to the relation between spatial objects and orbital maneuver phenomena, page 1, lines 16-19 and page 8, lines 1-21 state the following, respectively:

> "In the planning and analysis of spacecraft maneuvers, the creation of vectors, axes, points, coordinate systems and other elements and combinations thereof is required in order to describe the position and motion of rigid bodies in three-dimensional space (e.g., spacecraft orbits, trajectories, and maneuvers)."

> "The explicit means of creating coordinate systems and primitives (items 1-4, above) are carried out via user input, imported data from files or any other means of supplying numerical data to computer programs. In addition to geometrical relationships, coordinate system definitions can describe rates of change in the primitives, thus providing additional ways to create vectors:
> a. the rate of change of a vector constitutes another vector;
> b. the rate of change of a point (i.e., its velocity) constitutes a vector; and
> c. the rate of change of axes (rate of rotation or angular rate) constitutes a vector.
> The present invention gives users the ability to introduce new coordinate primitives by both direct specification through user/file input, and by building them out of existing primitives at run-time through the interface. Coordinate primitives created by both methods can then be reused immediately as building blocks for creating more primitives. The amount of actual coding needed to create a wide range of useful primitives is reduced dramatically compared to conventional systems, creation may be performed at run-time, and manageability of the code is improved since correction made to one of the primitives is automatically inherited by all primitives using this block.
> While the above description focuses on the use of the invention to create coordinate systems and primitives thereof, it is not intended that the invention be limited to this application. An aspect of the invention is its flexibility in allowing the user to define a variety of elements and combinations thereof for describing the position and movement of bodies in three-dimensional space."

With respect to "without needing to hard-code a software solution," claim 23 has been amended to clarify that this term by limiting it to "without needing to hard-code a software solution for new spatial objects" such that it is now clear what parameters *are not hard-coded* - new spatial objects. In regard to what the term "without needing to hard-code" means, the specification describes the prior art requiring "users to write new computer code whenever a new coordinate relationship is introduced. Alternatively, when a graphical user interface (GUI) is provided, the choices offered by the GUI are limited to a certain subset of the myriad possibilities, thus limiting the options available for the analyst" such that a new object not within the certain subset would require "hard-coding" in order to add.

For the above-mentioned reasons, Applicant submits that the written description satisfies the requirements of the second paragraph of 35 USC § 112 and requests reconsideration.

Claim Rejections - 35 USC § 103

Claims 1-32 were rejected under 35 USC § 103(a) as being unpatentable over the publication to Stodden in view of Watanabe et al. and the publication to Balovnev.

In making this rejection, part 9 of the Office Action impermissibly disregards the claims "as a whole" as required by M.P.E.P. 2141.02 by distilling the invention down to the "gist" or "thrust" of an invention. See *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). On this basis alone, the Office Action fails to make a *prima facie* case of obviousness. Indeed, *Applicant has not claimed*:

> "A method, computer system, code, and spacecraft maneuver analyst for creating target object based on parent object from user inputs by:
> Finding a target object in terms of parent objects (objects are spatial and orbital related)
> Building a combined transformation based on parent objects and creating target objects
> Defining a coordinate system from GUI"

as suggested by the Office Action on page 12.

The Office Action admits that Stodden fails to disclose "target object and parent object relationships." Despite the fact that this language is not part of any claim limitation, Applicant notes that it is widely known in the art that the SOAP program disclosed by Stodden is based upon the JPL SPICE Toolkit (see, e.g., page 30 of Exhibit G). Such software that relies on

SPICE was discussed on page 3, lines 5-12 of Applicant's specification as using a different methodology from the Applicant's invention:

> "Some existing programs require that all relationships of interest be hard-coded, whereas some require that only one relationship be hard-coded. For example, the Jet Propulsion Laboratory (JPL) distributes the SPICE toolkit that contains a set of functions to perform coordinate conversions. The conversions can be obtained between any two of the specified coordinate frames, with each new frame specified relative to some existing frame. Nevertheless, this is a laborious task, since the specification must be performed through a file. The JPL SPICE toolkit also lacks the ability to specify points or vectors, which are crucial building blocks for interrelating various coordinate systems."

Because of this, the SOAP system must translate and rotate the base coordinate system using a conversion file to define a new coordinate system, thus subscribing to the methods of the disclosed prior art. Additionally, Stodden teaches that the conversion of coordinate systems from the base coordinate system is sufficient for modeling space systems because all the other primitives are addressed separately. Architecturally, Stodden/SOAP teaches the modeling/definition of the various spatial objects by a variety of *different* ways. Platforms (see fig. 2, where all the platform objects are physical objects in space) are modeled separately from coordinate systems (see fig. 6), both of which are handled separately from the modeling of vectors (see fig. 7), time (see fig. 1), propagation (see figs. 3-5), sensor objects (fig. 9), and stabilization (fig. 12). It fails to teach or fairly suggest the desirability of defining new objects based on parent objects and, instead, *teaches away* from the present invention by defining various spatial objects in completely different manners.

Clearly, the only possible reason to modify the prior art publication of Stodden to achieve Applicant's claimed invention is impermissible hindsight. The hindsight reconstruction used in the Office Action rejection is highlighted by the fact that the cited prior art to Watanabe et al. is from the diverse/marginally analogous art of computer animation and the cited prior art to Balovnev is from the diverse art of GIS (geographic information systems). The primary relevance of these references is their liberal use of the word "object," which, in Watanabe et al., refers to the object being animated (not to spatial objects in general) and, in Balovnev, refers to object classes used in object-oriented programming. Note: the word "spatial" is used with "object" in Balovnev in defining programming objects since it deals with geographic modeling. Likewise, the parent/child relationships disclosed in Balovnev are merely an inherent element of object-oriented programming and has nothing to do with the present invention.

The motivational statement in the obviousness rejection also reflects impermissible hindsight reasoning:

> "An obvious motivation exists since this area of technology is highly competitive with many orbit analysis programs available in the market place (SOAP, JPL Spice [sic], STK Navigator, etc.) and large amounts of money being [sic] spent in product development and improvement. Accordingly, a skilled artisan would have made an effort to become aware of what capabilities had already been developed in the market place and, hence, would have been motivated to modify the teachings of Stodden with the teachings of Watanabe, and to further modify the teachings of Stodden with the teachings of Balovnev, in order to reduce development time and cost."

This motivational statement is erroneous and legally insufficient for a number of reasons:

- As mentioned in Stodden on page 370, "large amounts of money" are *not* "being spent;" instead, "The design process has been especially challenging because user requirements have often been implemented incrementally, *as funding became available*";
- As illustrated on page 30 of Exhibit G, the primary way development time and cost has been reduced is not by developing new code (as done by the Applicant), but by using freely available tools such as JPL's SPICE;
- The present invention does not reduce development time and cost (it actually increased it), rather, it reduces the time it takes for an analyst to add a new spatial object;
- Primary references are relied upon for their disclosure, not their teachings - and the "teachings of Stodden" that are obvious to modify are unnamed beyond "an orbit analysis program incorporating a graphic user interface;" and
- The overall motivation presented in the Office Action essentially reduces to "in a capitalist system, if there is money to be made, then the innovation is obvious" and relies on the false premise that resources will always be allocated efficiently - if this were true, all commercial products that compete with other commercial product would be obvious.

In view of the above-cited reasons, Applicant respectfully submits that the Office Action fails to make a *prima facie* case of obviousness and requests reconsideration and allowance of the claims.

Conclusion

Applicants submit that claims 23-32 are in condition for allowance and requests reconsideration of the application. If there remain any issues that may be disposed of via a telephonic interview, the Examiner is kindly invited to contact the undersigned at the local exchange given below.

Respectfully submitted,
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